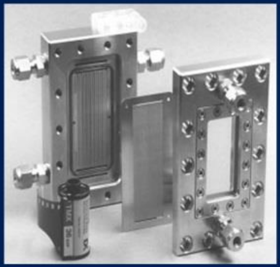

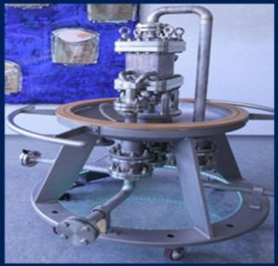

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Global Initiative of Academic Network

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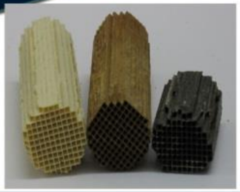
20th Dec. to 29th Dec., 2016

Microreactors: Mathematical Modelling Modelling of Hydrodynamics Heat and Mass Transfer, Design and Fabrication

Prof. Rufat Abiev is one of Institute Professors of St. Petersburg State Institute of Technology (Technical University) Russia, he is a Head of Department of Optimization of Chemical and Biotechnological Equipment (since 2008). Dr. Abiev has written approximately more than 200 publications, 5 books, 5 chapters in a "New Handbook of chemist & technologist" (in Russian), 2 chapters in "Engineering Ecology Handbook" (in Russian), more than 50 papers in peer-reviewed journals, more than 60 issued or pending patents in Russia and Kazakhstan. His research interests are Process Intensification, Microreactors, Process Simulation, Bubbles & Droplets break up, Heat & Mass Transfer intensification. He had received many international research grants: 2014 (DAAD) at Institut fuer Mikroverfahrenstechnik (KIT), 2006 Altana-Quandt Foundation, 2006 (DAAD) at Dept. of Chem. Engg. (TU Dresden), 1998 at Swiss Acad. of Engg. Sci. (SATW-Wissenschaften).

Dr. Ritunesh Kumar is working as an Associate Professor in the Mechanical Engineering Department of Indian Institute of Technology, Indore. His research interests are heat transfer at micro-scale, desiccant cooling system and biofuel.



Indian Institute of Technology Indore
Dept. of Mech. Engg.

About the Microreactors:

In the past two decades throughout the world investigations of micro- and minireactors are actively conducted for their use instead of conventional devices. Using of micro- and mini technologies cannot only improve the quality of end products, energy and resource consumption, but also increase the manufacturing mobility and possibility of its rapid readjusting to produce other products. Microreactors can be competitive for conducting fast reactions, when mass transfer limits a reaction rate. It is possible due to unusually high values of heat and mass transfer in microreactors. Another significant advantage of microreactors is a very narrow residence time distribution that can substantially reduce the formation of byproducts in the consecutive reactions. Microreactors can be used for the reactions in mixtures of gases as well as in gas–liquid, liquid–liquid systems and more recently for the synthesis of ionic liquids.

Objectives of the course:

i) Exposing participants to the fundamentals of microreactors design and fabrication, hydrodynamics, heat and mass transfer,
ii) Building in confidence and capability amongst the participants in the application of microreactors design and fabrication tools and techniques and mapping the organizational activities and problems in terms of mathematical modelling of hydrodynamics, heat and mass transfer, design and fabrication of microreactors,
iii) Providing exposure to practical problems and their solutions, through case studies and live projects in microreactors modelling,
iv) Enhancing the capability of the participants to identify, control and remove technical problems in microreactors like phases maldistribution, change in flow regime etc.

Module A: Fundamentals of microreactors: design, fabrication & hydrodynamics

Lecture 1: Fundamentals of microreactors design and fabrication
Lecture 2: One-channel & multichannel microreactors, maldistribution problems.
Tutorial 1: Problem solving session with examples: Diversity of Micro reactors and micro Heat Exchangers
Lecture 3: Two phase flows in microreactors.
Lecture 4: Hydrodynamics of Taylor flow - I (Bubble velocity, film thickness, slug velocity).
Lecture 5: Hydrodynamics of Taylor flow - II (Pressure gradients, velocity profiles. Impact of flow direction on bubble velocity. Stagnation of bubbles).
Lecture 6: Hydrodynamics of Taylor flow - III. Circulation and by-pass flow modes for Taylor flow. Criterion of transition between two modes. Capillary number. Modified Bond number.
Tutorial 2: Calculation of Taylor flow hydrodynamics. Pressure gradients, velocity profiles. Bubble velocity, film thickness, slug velocity.
Lecture 7: Hydrodynamics of Taylor flow - IV. Dynamic and real gas hold-up for Taylor flow. Calculation method of real gas hold-up. Relation between dynamic and real gas hold-up ratio and bubble velocity.
Lecture 8: Hydrodynamics of Taylor flow - V. Pressure drop: several origins of energy losses. Impact of wettability of microchannels. Experimental corroboration of theoretical approach.

Module B: Heat and mass transfer, simulation and optimization

Lecture 9: Mass and heat transfer intensification by means of Taylor flow. Experimental corroboration.
Lecture 10: Three layer mathematical model of mass transfer of Taylor flow - I. Geometrical structure of Taylor vortices.
Tutorial 3: Calculation of geometrical structure of Taylor vortices (three layer mathematical model of mass transfer).
Lecture 11: Three layer mathematical model of mass transfer of Taylor flow - II. Optimal flow regimes.
Lecture 12: Three layer mathematical model of mass transfer of Taylor flow - III. General results of mass transfer simulations and their practical benefits.
Tutorial 4: Calculation of hydrodynamics and mass transfer by means of three layer mathematical model of mass transfer of Taylor flow.
Lecture 13: Mathematical model of heat transfer of Taylor flow in microchannels.

Who can Attend……...

- You are a B.E./B. Tech, M.E./M.Tech., M.Sc., or Ph.D. students from all engg. & science discipline with interest in learning about microreactors.
- You are a faculty member from academic institution or a scientists working in research organization and have interest in initiating research on microreactors.
- You are a practicing engineer working in private organization and your work profile includes closely associated activities.

Maximum No. of Participants :- 60

Fees:-

Participants from abroad : US $500
Academic Institutions: Rs. 15000
Industry/Research Organizations: Single Module Rs. 20000 Both Module Rs. 30000
Students: Rs. 10000

The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges. The participants may be provided with hostel accommodation, depending on the availability, on payment basis.

For registration please visit IIT Indore GIAN website:
http://iiti.ac.in/GIAN/
or any quarries related with course, please send email to
ritunesh@iiti.ac.in
+918109112186